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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,438	06/26/2001	James L. Foran	15-4-1152.00	9657

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EXAMINER

YANG, RYAN R

ART UNIT	PAPER NUMBER
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2672

DATE MAILED: 06/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/888,438

Applicant(s)

FORAN, JAMES L.

Examiner

Ryan R Yang

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

1. Claims 1-11 are pending in this application. Claims 1 and 9 are independent claims. This action is non-final.
2. This application claims benefit of 60/219,006 dated 7/18/2000.
3. The present title of the invention is "Method and system for presenting three-dimensional computer graphics images using multiple graphics".

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Knittel et al. (6,532,017).

As per claim 1, Knittel et al., hereinafter Knittel, discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising the steps of:

(1) allocating, to each GPU, three-dimensional computer graphics data such that said allocated three-dimensional computer graphics data correspond to a portion of the

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scene that lies within the rectangular subvolume to which that GPU has been assigned (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipeline has the functions of a GPU);

(2) rendering, by each of the GPUs, said allocated three-dimensional computer graphics data (where each pipeline can perform "interpolation, classification, gradient estimation, illumination, and compositing", Abstract);

(3) combining said rendered three-dimensional computer graphics data, thereby producing a three-dimensional computer graphics image (Figure 4 29 "the colors, levels of brightness, and transparencies assigned to all of the samples along all of the rays are applied as illustrated at 29 to a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32 for display on image plane 16", column 9, line 34-40); and

(4) presenting, for viewing, said combined three-dimensional computer graphics image (Figure 4 32).

6. As per claim 2, Knittel demonstrated all the elements as applied to the rejection of independent claim 1, *supra*, and further discloses said allocating further comprises loading, into a memory cell accessible by that GPU, the three-dimensional computer graphics data corresponding to a portion of the scene that lies within the rectangular subvolume to which that GPU has been assigned (Figure 6 204 "section memory 204 is

used to store sections of a volume during rendering of the volume data set by the VRC", column 14, line 47-48 and Fig. 10 depicts loading of the subvolume to memory).

7. As per claim 3, Knittel demonstrated all the elements as applied to the rejection of independent claim 1, supra, and further discloses, before step (2), the steps of:

(5) determining a viewing position (Figure 1 depicts selecting a viewing direction);

and

(6) communicating said determined viewing position to each GPU ("A first interpolation unit 244 interpolates the z-gradient in the z direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU).

8. As per claim 4, Knittel demonstrated all the elements as applied to the rejection of dependent claim 3, supra, and further discloses said combining further comprises the step of:

(7) ordering said rendered three-dimensional computer graphics data based on locations between said determined viewing position and each rectangular subvolume (Figure 10 shows the subvolume is ordered into DRAM).

9. As per claim 5, Knittel demonstrated all the elements as applied to the rejection of independent claim 1, supra, and further discloses said combining further comprises the step of:

(8) blending said rendered three-dimensional computer graphics data (Figure 4 29 "a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32", column 9, line 36-39).

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10. As per claim 6, Knittel demonstrated all the elements as applied to the rejection of independent claim 1, supra, and further discloses said combining is performed by at least one image combiner (Figure 5A 124 where Figure 5A is a block diagram of a pipeline).

11. As per claim 7, Knittel demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and further discloses each of the at least one image combiner has an associated frame buffer for storing said combined three-dimensional computer graphics image (Figure 14 200 where the pixel memory stores said combined three-dimensional computer graphics image).

As per claim 8, Knittel demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and further discloses an output of the at least one image combiner is an input for another image combiner (Figure 14 where the output of 124 Compositing is output to Slice FIFO, to 250 Ray Shift Register, through MUX, then to next Compositing Unit).

12. As per claim 9, Knittel discloses a system for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising:

memory for storing three-dimensional computer graphics data (Figure 14 100);

at least one GPU for rendering the three-dimensional computer graphics data,

wherein each of said at least one GPU is assigned to a rectangular subvolume (Figure 7

V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4

parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from

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the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipeline has the functions of a GPU);

a communications means for communicating a viewing position to each of said at least one GPU ("A first interpolation unit 244 interpolates the z-gradient in the z direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU); and

at least one image combiner for combining the three-dimensional computer graphics data rendered by said at least one GPU, to produce a three-dimensional computer graphics image (Figure 14 has a plurality of Compositing Unit).

13. As per claim 10, Knittel demonstrated all the elements as applied to the rejection of independent claim 9, supra, and further discloses said memory is memory cells such that each said memory cell is accessible by only one of said at least one GPU ("The voxels are supplied to the pipelines 210-0- 212-3, respectively, in 4-voxel groups in a scanned order", column 15, line 9-11).

14. As per claim 11, Knittel demonstrated all the elements as applied to the rejection of independent claim 9, supra, and further discloses wherein at least one of said at least one image combiner is configured to receive the output of at least one other of said at least one image combiner (Figure 14 where the output of 124 Compositing is output to Slice FIFO, to 250 Ray Shift Register, through MUX, then to next Compositing Unit).

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Inquiries

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Ryan Yang** whose telephone number is **(703) 308-6133**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Michael Razavi**, can be reached at **(703) 305-4713**.

Any response to this action should be mailed to:

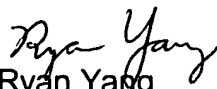
Commissioner of Patents and Trademarks
Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.


Ryan Yang
June 19, 2003